# IBM SATA 1.8-inch and 2.5-inch MLC Enterprise SSDs for IBM System x

## IBM Redbooks Product Guide

The IBM® SATA 1.8-inch and 2.5-inch MLC Enterprise solid-state drives (SSDs) for IBM System x® employ enterprise MLC NAND technology to bring an affordable, but performance-driven solution for applications requiring enterprise workloads with a mix of read-write operations. These industry standard 1.8-inch and 2.5-inch form factor SSD drives use a single-chip controller with a SATA interface on the system side and n-channels of NAND flash internally. They are targeted at databases and other enterprise workloads that require high I/O performance in random read and write operations including applications caching and tiering. The 1.8-inch SSDs can also be configured into the IBM eXFlash solution for maximum capacity and performance.

Figure 1 shows the IBM SATA 1.8-inch MLC Enterprise SSD.

Figure 1. IBM SATA 1.8-inch MLC Enterprise SSD

## Did you know

IBM SATA MLC Enterprise solid-state drives for System x can be fully re-written up to eight times per day throughout their entire five-year life expectancy. These SSDs provide outstanding performance, endurance, reliability, and energy efficiency for both read- and write-intensive enterprise applications such as databases, data warehouses, corporate email and collaboration, actively connected users, medical imaging, and others.

Providing additional peace of mind, IBM SATA 1.8-inch and 2.5-inch Enterprise MLC SSDs are covered under IBM warranty. The drives carry a 1-year limited warranty, or when installed in an IBM System x server, these drives assume your system's base warranty.

## Part number information

Table 1 lists the information for ordering part numbers and feature codes.

Table 1. Ordering part numbers and feature codes

| Description | Part number | Feature code |
|---|---|---|
| 2.5-inch SSDs | | |
| IBM 100GB SATA 2.5" MLC HS Enterprise SSD | 00W1125 | A3HR |
| IBM 100GB SATA 2.5" MLC SS Enterprise SSD | 00W1130 | A3HS |
| 1.8-inch SSDs | | |
| IBM 100GB SATA 1.8" MLC Enterprise SSD | 00W1120 | A3HQ |
| IBM 200GB SATA 1.8" MLC Enterprise SSD | 49Y6119 | A3AN |
| IBM 400GB SATA 1.8" MLC Enterprise SSD | 49Y6124 | A3AP |

The part numbers include the following items:

- One SSD without a drive tray (1.8-inch SSDs) or one SSD with a hot-swap or simple-swap drive tray (2.5-inch SSDs)
- Technical Update Flyer
- Warranty Flyer
- *Important Notices* document

Figure 2 shows the IBM SATA 2.5-inch MLC Enterprise SSD.

Figure 2. IBM SATA 2.5-inch MLC Enterprise SSD

## Features

- Industry standard 1.8-inch or 2.5-inch form factors
- Support for standard 2.5-inch drive bay (2.5-inch SSDs) or eXFlash drive bay (1.8-inch SSDs) or SSD drive bay (1.8-inch SSDs) on selected System x, IBM iDataPlex®, IBM BladeCenter® and IBM Flex System™ servers
- Utilizes industry leading 24 nm MLC
- Cost-effective enterprise-grade MLC (eMLC) NAND technology
- MLC SATA drive with high read and write performance to fulfill client needs in the enterprise space
- High endurance, with up to six PB of total bytes written (TBW) to withstand applications with intensive read-write workloads
- Energy saving, with as little as 2.8 - 4.6 watt power consumption per drive
- Absence of moving parts to reduce potential failure points in the server
- Native command queueing (NCQ) with a queue depth of 32
- S.M.A.R.T. support
- Advanced Encrypting Standard (AES) 256-bit encryption
- Enterprise data path protection
- 55 bits per 512-byte sector ECC/EDC (BCH)
- Static wear leveling evenly distributes data across the drive
- Bad block management replaces failed blocks with new ones from the spare pool
- Performance throttling to ensure the lifetime expectation is met
- Power and thermal throttling to extend the life of the drive
- Data retention management to ensure availability and integrity of stored data
- Minimal write amplification for efficient flash utilization and extended life time

The key difference between Enterprise SSDs and Enterprise Value SSDs is their endurance (or life expectancy). SSDs have a huge but finite number of program/erase (P/E) cycles, which affects how long they can perform write operations and thus their life expectancy. Enterprise SSDs have significantly better endurance but higher cost/IOPS ratio compared to Enterprise Value SSDs. SSD write endurance is typically measured by the number of program/erase cycles that the drive can incur over its lifetime, listed as TBW in the device specification.

For example, with IBM 400 GB SATA 1.8-inch MLC Enterprise SSD, the entire 400 GB can be fully re-written up to eight times per day (more than 3 TB writes per day) to meet the five-year lifetime expectation of the drive, while the Enterprise Value SSD can only sustain up to 40 GB writes per day (75 times less) to provide the same five-year lifetime.

## Technical specifications

Table 2 presents technical specifications for the IBM SATA MLC Enterprise solid-state drives.

Table 2. IBM SATA MLC Enterprise SSD technical specifications

| Specification | 100 GB | | | 200 GB | 400 GB |
|---|---|---|---|---|---|
| Part number | 00W1120 | 00W1125 | 00W1130 | 49Y6119 | 49Y6124 |
| Interface | 6 Gbps SATA | 6 Gbps SATA | 6 Gbps SATA | 6 Gbps SATA | 6 Gbps SATA |
| Hot-swap drive | Yes§ | Yes | No | Yes§ | Yes§ |
| Form factor | 1.8-inch | 2.5-inch | 2.5-inch | 1.8-inch | 1.8-inch |
| Capacity | 100 GB | 100 GB | 100 GB | 200 GB | 400 GB |
| Endurance | 5-year life time (1.5 PB TBW) | 5-year life time (1.5 PB TBW) | 5-year life time (1.5 PB TBW) | 5-year life time (3 PB TBW) | 5-year life time (6 PB TBW) |
| Data reliability | < 1 in $10^{18}$ bits read | < 1 in $10^{18}$ bits read | < 1 in $10^{18}$ bits read | < 1 in $10^{18}$ bits read | < 1 in $10^{18}$ bits read |
| MTBF | > 2,500,000 hours | > 2,500,000 hours | > 2,500,000 hours | > 2,500,000 hours | > 2,500,000 hours |
| IOPS read* | 60,000 | 60,000 | 60,000 | 60,000 | 60,000 |
| IOPS write* | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 |
| Sequential read rate† | 520 MBps | 520 MBps | 520 MBps | 520 MBps | 520 MBps |
| Sequential write rate† | 500 MBps | 500 MBps | 500 MBps | 500 MBps | 500 MBps |
| Access time | < 0.1 ms | < 0.1 ms | < 0.1 ms | < 0.1 ms | < 0.1 ms |
| Shock | 200 *g*, 10 ms<br>1500 *g*, 1 ms<br>1000 *g,* 0.5 ms | 200 *g*, 10 ms<br>1500 *g*, 1 ms<br>1000 *g,* 0.5 ms | 200 *g*, 10 ms<br>1500 *g*, 1 ms<br>1000 *g,* 0.5 ms | 200 *g*, 10 ms<br>1500 *g*, 1 ms<br>1000 *g,* 0.5 ms | 200 *g*, 10 ms<br>1500 *g*, 1 ms<br>1000 *g,* 0.5 ms |
| Vibration, operating | 0.67 *g* rms<br>5-500 Hz | 0.67 *g* rms<br>5-500 Hz | 0.67 *g* rms<br>5-500 Hz | 0.67 *g* rms<br>5-500 Hz | 0.67 *g* rms<br>5-500 Hz |
| Vibration, non-operating | 1.04 *g* rms<br>2-200 Hz | 1.04 *g* rms<br>2-200 Hz | 1.04 *g* rms<br>2-200 Hz | 1.04 *g* rms<br>2-200 Hz | 1.04 *g* rms<br>2-200 Hz |
| Typical power, reads | 2.8 W | 2.8 W | 2.8 W | 2.8 W | 2.8 W |
| Typical power, writes | 4.6 W | 4.6 W | 4.6 W | 4.6 W | 4.6 W |

§ This SSD can be a hot-swap or non-hot-swap drive depending on the server in which it is installed.
* 4 KB block transfers
† 128 KB block transfers

The TBW value assigned to a solid-state device is the total bytes of written data (based on the number of P/E cycles) that a drive can be guaranteed to complete (% of remaining P/E cycles = % of remaining TBW). Reaching this limit does not cause the drive to immediately fail; the TBW simply denotes the maximum number of writes that can be guaranteed. A solid-state device will not fail upon reaching the specified TBW, but at some point after surpassing the TBW value (and based on manufacturing variance margins), the drive will reach the end-of-life point, at which time the drive will go into read-only mode. Because of such behavior by solid-state drives, careful planning must be done to use SSDs in the application environments to ensure that the TBW of the drive will not be exceeded prior to the required life expectancy.

## Supported servers

The IBM SATA MLC Enterprise SSDs and supported RAID controllers can be installed in the System x and iDataPlex servers identified in Table 3 and the BladeCenter and Flex System servers identified in Table 4.

Table 3. Supported System x and iDataPlex servers (Part 1)

| Part number | Product description | x3200 M3 (7327, 7328) | x3250 M3 (4251, 4252) | x3400 M3 (7378, 7379) | x3500 M3 (7380) | x3550 M3 (7944) | x3620 M3 (7376) | x3630 M3 (7377) | x3650 M3 (7945) | x3755 M3 (7164) | dx360 M3 (6391) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 00W1120 | IBM 100GB SATA 1.8" MLC Enterprise SSD | N | N | N | N | N | N | N | N | N | N |
| 00W1125 | IBM 100GB SATA 2.5" MLC HS Enterprise SSD | Y | Y | Y | Y | Y | N | Y | Y | N | N |
| 00W1130 | IBM 100GB SATA 2.5" MLC SS Enterprise SSD | N | N | N | N | Y | N | N | N | N | Y |
| 49Y6119 | IBM 200GB SATA 1.8" MLC Enterprise SSD | N | N | N | N | N | N | N | N | N | N |
| 49Y6124 | IBM 400GB SATA 1.8" MLC Enterprise SSD | N | N | N | N | N | N | N | N | N | N |

Table 3. Supported System x and iDataPlex servers (Part 2)

| Part number | Product description | x3100 M4 (2582) | x3250 M4 (2583) | x3300 M4 (7382) | x3500 M4 (7383) | x3530 M4 (7160) | x3550 M4 (7914) | x3630 M4 (7158) | x3650 M4 (7915) | x3690 X5 (7147) | x3750 M4 (8722) | x3850 X5 (7143) | dx360 M4 (7912) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00W1120 | IBM 100GB SATA 1.8" MLC Enterprise SSD | N | N | N | N | N | N | N | Y | Y | Y | Y | N |
| 00W1125 | IBM 100GB SATA 2.5" MLC HS Enterprise SSD | Y | Y | Y | Y | Y | Y | N | Y | Y | Y | Y | N |
| 00W1130 | IBM 100GB SATA 2.5" MLC SS Enterprise SSD | N | Y | N | N | Y | N | N | N | N | N | N | Y |
| 49Y6119 | IBM 200GB SATA 1.8" MLC Enterprise SSD | N | N | N | N | N | N | N | Y | Y | Y | Y | N |
| 49Y6124 | IBM 400GB SATA 1.8" MLC Enterprise SSD | N | N | N | N | N | N | N | Y | Y | Y | Y | N |

Table 4. Supported BladeCenter and Flex System servers

| Part number | Product description | HS12 (8028) | HS22 (7870) | HS22V (7871) | HS23 (7875) | HS23E (8038) | HX5 (7873) | x220 (7906) | x240 (8737) | x440 (7917) |
|---|---|---|---|---|---|---|---|---|---|---|
| 00W1120 | IBM 100GB SATA 1.8" MLC Enterprise SSD | N | N | Y | N | N | Y | N | N | N |
| 00W1125 | IBM 100GB SATA 2.5" MLC HS Enterprise SSD | N | Y | N | Y | Y | N | Y | Y | Y |
| 00W1130 | IBM 100GB SATA 2.5" MLC SS Enterprise SSD | N | N | N | N | N | N | N | N | N |
| 49Y6119 | IBM 200GB SATA 1.8" MLC Enterprise SSD | N | N | Y | N | N | Y | N | N | N |
| 49Y6124 | IBM 400GB SATA 1.8" MLC Enterprise SSD | N | N | Y | N | N | Y | N | N | N |

See the IBM ServerProven® website for the latest compatibility information for System x, BladeCenter, iDataPlex and Flex System servers: http://ibm.com/servers/eserver/serverproven/compat/us/

## Supported storage controllers

The IBM SATA MLC Enterprise SSDs require a supported disk controller. Table 5 lists the System x controllers that support these solid-state drives installed in a supported server. Table 6 lists the BladeCenter and Flex System controllers that support these solid-state drives installed in a supported server.

Table 5. RAID controllers for System x and iDataPlex servers supported with internal SSDs (Part 1)

| Part number | Product description | x3200 M3 (7327, 7328) | x3250 M3 (4251, 4252) | x3400 M3 (7378, 7379) | x3500 M3 (7380) | x3550 M3 (7944) | x3620 M3 (7376) | x3630 M3 (7377) | x3650 M3 (7945) | x3755 M3 (7164) | dx360 M3 (6391) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 81Y4492 | ServeRAID H1110 SAS/SATA Controller | Y | Y | Y | Y | Y | N | N | Y | N | N |
| 90Y4304 | ServeRAID M5016 SAS/SATA Controller | N | N | N | N | Y | N | N | Y | N | N |
| 46M0829 | ServeRAID M5015 SAS/SATA Controller | Y | Y | Y | Y | Y | N | Y | Y | N | Y |
| 46M0916 | ServeRAID M5014 SAS/SATA Controller | Y | Y | Y | Y | Y | N | Y | Y | N | Y |
| 46M0831 | ServeRAID M1015 SAS/SATA Controller | Y | Y | Y | Y | Y | N | Y | Y | N | Y |
| 46M0969 | ServeRAID B5015 SSD Controller | N | N | N | N | Y | N | N | Y | N | N |
| 49Y4731 | ServeRAID-BR10il SAS/SATA Controller v2 | N | N | N | N | Y | N | N | Y | N | N |
| 46M0912 | IBM 6Gb Performance Optimized HBA | Y | Y | Y | Y | Y | N | Y | Y | N | Y |

Table 5. RAID controllers for System x and iDataPlex servers supported with internal SSDs (Part 2)

| Part number | Product description | x3100 M4 (2582) | x3250 M4 (2583) | x3300 M4 (7382) | x3500 M4 (7383) | x3530 M4 (7160) | x3550 M4 (7914) | x3630 M4 (7158) | x3650 M4 (7915) | x3690 X5 (7147) | x3750 M4 (8722) | x3850 X5 (7143) | dx360 M4 (7912) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Onboard | ServeRAID M5110e SAS/SATA Controller | N | N | N | N | N | N | N | Y | N | Y | N | N |
| 81Y4481 | ServeRAID M5110 SAS/SATA Controller | N | N | Y | Y | Y | Y | N | Y | N | Y | N | Y |
| 81Y4448 | ServeRAID M1115 SAS/SATA Controller | N | N | Y | Y | Y | Y | N | N | N | Y | N | Y |
| 81Y4492 | ServeRAID H1110 SAS/SATA Controller | Y | Y | Y | N | Y | Y | N | N | N | N | N | Y |
| 90Y4304 | ServeRAID M5016 SAS/SATA Controller | N | N | N | N | N | N | N | N | Y | N | Y | N |
| 46M0829 | ServeRAID M5015 SAS/SATA Controller | Y | Y | N | N | N | N | N | N | Y | N | Y | N |
| 46M0916 | ServeRAID M5014 SAS/SATA Controller | Y | Y | N | N | N | N | N | N | Y | N | Y | N |
| 46M0831 | ServeRAID M1015 SAS/SATA Controller | Y | Y | N | N | N | N | N | N | Y | N | Y | N |
| 46M0969 | ServeRAID B5015 SSD Controller | N | N | N | N | N | N | N | N | Y | N | Y | N |
| Onboard | ServeRAID C105 | N | N | N | N | N | N | N | N | N | N | N | N |
| Onboard | ServeRAID C100 | N | N | N | N | N | N | N | N | N | N | N | N |
| 46M0912 | IBM 6Gb Performance Optimized HBA | Y | Y | Y | Y | Y | Y | N | Y | Y | Y | Y | Y |

Table 6. RAID controllers for BladeCenter and Flex System servers supported with internal SSDs

| Part number | Product description | HS12 (8028) | HS22 (7870) | HS22V (7871) | HS23 (7875) | HS23E (8038) | HX5 (7873) | x220 (7906) | x240 (8737) | x440 (7917) |
|---|---|---|---|---|---|---|---|---|---|---|
| 90Y4390 | ServeRAID M5115 SAS/SATA Controller | N | N | N | N | N | N | Y | Y | Y |
| 90Y4750 | ServeRAID H1135 Controller | N | N | N | N | Y | N | Y | N | N |
| Onboard | ServeRAID C105 | N | N | N | N | N | N | N | N | N |
| Onboard | Integrated LSI SAS2004 | N | N | N | Y | N | N | N | Y | Y |
| 46C7167 | ServeRAID-MR10ie (CIOv) Controller | N | N | N | N | N | N | N | N | N |
| Onboard | Integrated LSI SAS1064e | N | Y | Y | N | N | N | N | N | N |
| 46M6908 | SSD Expansion Card for IBM BladeCenter HX5 | N | N | N | N | N | Y | N | N | N |

See the IBM ServerProven website for the latest information about the adapters supported by each System x server type: http://ibm.com/servers/eserver/serverproven/compat/us/

## Supported operating systems

Solid-state drives operate transparently to users, storage systems, applications, databases, and operating systems. The controllers that support SSDs are supported by the following operating systems:

- Microsoft Windows Server 2012
- Microsoft Windows Server 2008 R2
- Microsoft Windows Server 2008, Datacenter x64 Edition
- Microsoft Windows Server 2008, Datacenter x86 Edition
- Microsoft Windows Server 2008, Enterprise x64 Edition
- Microsoft Windows Server 2008, Enterprise x86 Edition
- Microsoft Windows Server 2008, Standard x64 Edition
- Microsoft Windows Server 2008, Standard x86 Edition
- Microsoft Windows Server 2008, Web x64 Edition
- Microsoft Windows Server 2008, Web x86 Edition
- Microsoft Windows Server 2008 Foundation
- Microsoft Windows Small Business Server 2008 Premium Edition
- Microsoft Windows Small Business Server 2008 Standard Edition
- Microsoft Windows Server 2003/2003 R2, Datacenter Edition
- Microsoft Windows Server 2003/2003 R2, Datacenter x64 Edition
- Microsoft Windows Server 2003/2003 R2, Enterprise Edition
- Microsoft Windows Server 2003/2003 R2, Enterprise x64 Edition
- Microsoft Windows Server 2003/2003 R2, Standard Edition
- Microsoft Windows Server 2003/2003 R2, Standard x64 Edition
- Microsoft Windows Server 2003, Web Edition
- Microsoft Windows Small Business Server 2003/2003 R2 Premium Edition
- Microsoft Windows Small Business Server 2003/2003 R2 Standard Edition
- Red Hat Enterprise Linux 6 Server Edition
- Red Hat Enterprise Linux 6 Server x64 Edition
- Red Hat Enterprise Linux 5 Server Edition
- Red Hat Enterprise Linux 5 Server Edition with Xen
- Red Hat Enterprise Linux 5 Server with Xen x64 Edition
- Red Hat Enterprise Linux 5 Server x64 Edition
- Red Hat Enterprise Linux 4 AS for AMD64/EM64T
- Red Hat Enterprise Linux 4 AS for x86
- SUSE LINUX Enterprise Server 11 for AMD64/EM64T
- SUSE LINUX Enterprise Server 11 for x86
- SUSE LINUX Enterprise Server 11 with Xen for AMD64/EM64T
- SUSE LINUX Enterprise Server 10 for AMD64/EM64T
- SUSE LINUX Enterprise Server 10 for x86
- SUSE LINUX Enterprise Server 10 with Xen for AMD64/EM64T
- VMware vSphere 5.1
- VMware vSphere 5
- VMware ESX 4.0
- VMware ESX 4.1
- VMware ESXi 4.0
- VMware ESXi 4.1

See the IBM ServerProven website for the latest information about the specific versions and service packs supported: http://ibm.com/servers/eserver/serverproven/compat/us/. Click **System x servers**, then **Disk controllers** to see the support matrix. Click the check mark that is associated with the System x server in question to see the details about operating system support.

## Warranty

The IBM SATA 1.8-inch and 2.5-inch MLC Enterprise SSDs carry a 1-year, customer-replaceable unit (CRU) limited warranty. When installed in a System x server, these drives assume your system's base warranty and any IBM ServicePac® upgrade.

## Physical specifications

The IBM SATA 1.8-inch MLC Enterprise SSDs have the following physical specifications.

Dimensions and weight (approximate):

- Height: 5 mm (0.2 in.)
- Width: 54 mm (2.1 in.)
- Depth: 79 mm (3.1 in.)
- Weight: 39 g (0.1 lb)

Shipping dimensions and weight (approximate):

- Height: 32 mm (1.3 in.)
- Width: 226 mm (8.9 in.)
- Depth: 150 mm (5.9 in.)
- Weight: 400 g (0.9 lb)

The IBM SATA 2.5-inch MLC Enterprise SSDs have the following physical specifications.

Dimensions and weight (approximate):

- Height: 9 mm (0.4 in.)
- Width: 70 mm (2.8 in.)
- Depth: 100 mm (4.0 in.)
- Weight: 99 g (0.2 lb)

Shipping dimensions and weight (approximate):

- Height: 63 mm (2.5 in.)
- Width: 174 mm (6.9 in.)
- Depth: 133 mm (5.2 in.)
- Weight: 448 g (1.0 lb)

## Operating environment

The IBM SATA 1.8-inch and 2.5-inch MLC Enterprise SSDs are supported in the following environment:

- Temperature: 0 - 70 °C (32 - 158°F)
- Relative humidity: 8 - 85% (noncondensing)
- Maximum altitude: 3,050 m (10,000 ft)

## Agency approvals

The  IBM SAT 1.8-inch and 2.5-inch MLC Enterprise SSDs have the following agency approvals:

- UL
- CSA
- TUV
- FCC
- EMC
- CE Mark
- C-Tick Mark
- Taiwan (BSMI Certification)
- Korea EMI

## Related publications

For more information see the following documents:

- IBM US Announcement Letter for 200 GB and 400 GB 1.8-inch MLC Enterprise SSDs
  http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS112-150
- IBM US Announcement Letter for 100 GB 1.8-inch and 2.5-inch MLC Enterprise SSDs
  http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS112-178
- IBM Redbooks® ServeRAID Adapter Quick Reference
  http://www.redbooks.ibm.com/abstracts/tips0054.html?Open
- *IBM System x Configuration and Options Guide*
  http://www.ibm.com/support/docview.wss?uid=psg1SCOD-3ZVQ5W
- IBM ServerProven
  http://ibm.com/servers/eserver/serverproven/compat/us/

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